

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 2000

BUDGET ACTIVITY

PE NUMBER AND TITLE

03 - Advanced Technology Development**0603605F Advanced Weapons Technology**

COST (\$ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	51,477	56,805	33,371	33,904	37,496	41,646	45,354	Continuing	TBD
633150 Advanced Optics Technology	14,226	18,697	545	760	777	4,253	5,115	Continuing	TBD
633151 High Power Solid State Laser Technology	9,540	8,866	5,692	5,959	8,489	9,727	10,096	Continuing	TBD
633152 High Power Microwave Technology	7,926	7,490	8,658	9,290	9,932	8,686	8,858	Continuing	TBD
633647 High Energy Laser Technology	19,785	21,752	18,476	17,895	18,298	18,980	21,285	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0

(U) A. Mission Description

This program demonstrates advanced directed energy and optical imaging concepts. Speed-of-light weapons and long-range, high resolution optical imaging through the turbulent atmosphere offer significant payoffs for many Air Force missions, such as theater missile defense, suppression of enemy air defenses, and control of space. This program has already demonstrated many major technological breakthroughs such as removing significant atmospheric distortions from optical transmissions (e.g., laser beams) and producing high power solid state and chemical lasers. Major emphasis areas include: high power microwave and high energy laser technologies; long-range optical imaging; and high power solid state lasers. Within high energy lasers the emphasis is on developing methods to increase the power on target. This is done by continuing to remove more of the atmospheric degradations and to develop more efficient laser devices. Because of the unique effects associated with high power microwaves there are many potential applications ranging from low power disruptions to high power destruction of electronic devices. Thus, a wide range of high power microwave technologies are being developed. Long-range optical imaging offers high resolution images of space objects from the ground for applications such as satellite status assessments. Long-range imaging technologies are demonstrated at the Starfire Optical Range at Kirtland Air Force Base, NM, and at the Maui Space Surveillance System (MSSS) in Hawaii. High power solid state lasers offer great potential for very small optical sources at many wavelengths for applications such as infrared illuminators and infrared countermeasure sources as well as weapon applications. This PE will continue to develop a wide range of directed energy technologies for many DoD applications. Note: Congress added \$6 million for Field Laser Radar upgrades, \$12 million for Geo Laser Imaging National Testbed (GLINT), and \$2.5 million for LaserSpark Missile Countermeasures in FY 2000.

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03 - Advanced Technology Development

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0603605F Advanced Weapons Technology(U) **B. Budget Activity Justification**

This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

(U) **C. Program Change Summary (\$ in Thousands)**

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>Total Cost</u>
(U) Previous President's Budget (FY 2000 PBR)	53,317	38,995	34,225	
(U) Appropriated Value	53,653	57,495		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-336			
b. Small Business Innovative Research	-1,654			
c. Omnibus or Other Above Threshold Reprogram		-312		
d. Below Threshold Reprogram	102			
e. Rescissions	-288	-378		
f. Other				TBD
(U) Adjustments to Budget Years Since FY 2000 PBR			-854	
(U) Current Budget Submit/FY 2001 PBR	51,477	56,805	33,371	TBD

(U) **Significant Program Changes:**

Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 2000	
BUDGET ACTIVITY 03 - Advanced Technology Development				PE NUMBER AND TITLE 0603605F Advanced Weapons Technology				PROJECT 633150	
COST (\$ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
633150 Advanced Optics Technology	14,226	18,697	545	760	777	4,253	5,115	Continuing	TBD
<p>(U) <u>A. Mission Description</u> This project develops advanced optical technologies for locating, identifying, and analyzing distant and/or dim objects. This work supports high energy laser applications in target verification, accurate and sustainable laser beam placement on target, and near-real-time damage assessment. Several advanced technologies including nonlinear optics (NLO), adaptive optics, and specialized optical processing are being developed. The goal is high quality optical image reconstruction, concentrating on removing turbulent atmosphere-induced distortions. Many of the technologies developed/being developed have significant application to astronomy research.</p> <p>(U) <u>FY 1999 (\$ in Thousands)</u></p> <p>(U) \$705 Continued to develop and demonstrate advanced technologies which increase resolution and data fusion for very long-range optical imaging to support missions such as space object identification and ground target identification from space.</p> <p>(U) \$468 Continued to develop nonlinear optics technologies for non-mechanical corrections in optical imaging.</p> <p>(U) \$101 Continued to develop and demonstrate signature technology for identifying and assessing health and status of satellites out to geosynchronous orbit.</p> <p>(U) \$7,196 Continued to develop technologies for active imaging of geosynchronous space objects.</p> <p>(U) \$5,756 Continued upgrades to the Field Laser Demonstrator for increased sensitivity to obtain very accurate data on space objects and to evaluate techniques for remote sensing of the atmosphere.</p> <p>(U) \$14,226 Total</p> <p>(U) <u>FY 2000 (\$ in Thousands)</u></p> <p>(U) \$305 Develop nonlinear optics technologies for non-mechanical beam correction for laser beam projection and optical imaging. Investigate the use of a single NLO device to optically correct a subscale bifocal relay mirror breadboard. Test the laboratory breadboard at operationally significant wavelengths into the infrared.</p> <p>(U) \$150 Investigate advanced concepts to deploy and use very large optical mirrors in orbit for applications that support missions such as imaging and laser beam projection and relay. Investigate and develop the materials and techniques for instilling shape and curvature memory into thin membrane mirrors so that they will deploy on orbit to a predetermined shape and curvature. This eliminates pressure canopies which cause optical distortions.</p> <p>(U) \$242 Investigate novel signature techniques for assessing the operational status of satellites out to geosynchronous orbit. Continue the evaluation of</p>									
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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
03 - Advanced Technology Development	0603605F Advanced Weapons Technology	633150
(U) <u>A. Mission Description Continued</u>		
(U) <u>FY 2000 (\$ in Thousands) Continued</u>		
	techniques for identifying classes of satellites at geosynchronous range. Transition those identification techniques that are successful to the Air Force Space Command for operational use. Investigate new techniques for individual satellite identification and for health status assessments.	
(U) \$12,000	Continue to develop technologies for active imaging of geosynchronous space objects. Complete design, verify through simulation design parameters, and buy initial hardware for receiver for the Geo Light Imaging National Testbed at White Sands Missile Range, NM.	
(U) \$6,000	Continue upgrades to the Field Laser Demonstrator for increased sensitivity to obtain very accurate data on space objects and to evaluate techniques for remote sensing of the atmosphere. Continue to install a laser radar system on the Advanced Electro Optical System telescope on Maui, HI. Perform experiments for space applications such as high accuracy orbital measurements, imaging for target identification, and satellite status assessment.	
(U) \$18,697	Total	
(U) <u>FY 2001 (\$ in Thousands)</u>		
(U) \$180	Develop nonlinear optics technologies for non-mechanical beam correction for laser beam projection and optical imaging. Demonstrate with a breadboard, applications such as target designation and remote sensing in a controlled environment. Pursue the development of these technologies in a scalable manner for beam projection using an orbiting platform with nonlinear optics correction techniques.	
(U) \$280	Investigate advanced concepts to deploy and use very large optical mirrors in orbit for applications that support missions such as imaging and laser beam projection and relay. Continue to pursue component development of nonlinear optical materials/devices that can be scaled to much larger sizes with required speed, resolution, and greater power handling capability.	
(U) \$85	Investigate novel signature techniques for assessing the operational status of satellites out to geosynchronous orbit. Field test and demonstrate advance signature techniques for determining the health, status, and operational assessment of satellites out to geosynchronous range. Develop techniques to permit processing of multiple wavelength signatures simultaneously through aperture sharing elements that could be available for an early transition to operational assets.	
(U) \$545	Total	
(U) <u>B. Project Change Summary</u>		
Not Applicable.		
Project 633150		
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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
03 - Advanced Technology Development	0603605F Advanced Weapons Technology	633150
<p>(U) <u>C. Other Program Funding Summary (\$ in Thousands)</u></p> <p>(U) Related Activities:</p> <p>(U) PE 0603444F, Maui Space Surveillance Systems.</p> <p>(U) PE 0602102F, Materials.</p> <p>(U) PE 0602605F, Directed Energy Technology.</p> <p>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</p> <p>(U) <u>D. Acquisition Strategy</u></p> <p>Not Applicable.</p> <p>(U) <u>E. Schedule Profile</u></p> <p>(U) Not Applicable.</p>		
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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 2000	
BUDGET ACTIVITY 03 - Advanced Technology Development				PE NUMBER AND TITLE 0603605F Advanced Weapons Technology				PROJECT 633151	
COST (\$ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
633151 High Power Solid State Laser Technology	9,540	8,866	5,692	5,959	8,489	9,727	10,096	Continuing	TBD
<p>(U) <u>A. Mission Description</u></p> <p>This project continues to yield revolutionary breakthroughs in compact, robust, and affordable laser system technology for a wide range of military applications requiring small compact laser sources with low to moderate optical power. This is a long-term technology development project with both near-term and long-term goals. Near-term goals include developing compact, reliable infrared sources that can be used for a range of applications including night vision systems, landing zone markers, remote sensing, and covert communication systems. Longer-term goals focus on producing compact, significantly higher power sources that could be applied to military applications including aircraft protection. This project leads the development of, and builds upon, a wide range of commercial advancements. Commercially available solid state lasers are widely used due to their low-cost, small size and weight, high reliability, and high efficiency in converting electricity to laser energy. This project preserves these attractive features while continually scaling output to higher powers and efficiencies and to military application-specific wavelengths. This project is divided into two technology areas. The first area investigates methods to develop low-cost, scalable, high power solid state lasers. This effort builds upon a strong industrial technology base. Secondly, wavelength specific solid state lasers for military applications such as infrared countermeasures are developed.</p> <p>(U) <u>FY 1999 (\$ in Thousands)</u></p> <p>(U) \$1,982 Continued to develop laser diodes for improved performance/higher power as sources in near-term applications such as illumination, designation, and communication and for incorporation into laser diode array architectures.</p> <p>(U) \$1,127 Continued to develop scalable laser arrays (fiber/diode) for improved performance in applications requiring high power levels and beam quality such as designating/tracking sources for airborne laser and ground-based laser applications and as weapon sources for degrade and damage in aircraft self-protection applications.</p> <p>(U) \$3,908 Continued to develop semiconductor diode lasers and optically-pumped semiconductor lasers to support current advanced infrared countermeasures system upgrades to tactical fixed and rotary-winged aircraft. Development focused on concepts with the potential for high efficiency, compact infrared laser sources covering Bands 2 and 4.</p> <p>(U) \$2,523 Continued to develop the basic laser source and target coupling technologies needed to damage/destroy missile seeker components of next generation advanced imaging infrared-guided air-to-air and surface-to-air missiles.</p> <p>(U) \$9,540 Total</p>									
<div style="display: flex; justify-content: space-between;"> Project 633151 Page 6 of 15 Pages Exhibit R-2A (PE 0603605F) </div>									

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BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT 633151
<p>(U) <u>A. Mission Description Continued</u></p> <p>(U) <u>FY 2000 (\$ in Thousands)</u></p> <p>(U) \$4,204 Develop low-cost, scalable, high power solid state laser architectures by integrating doped fiber lasers with diode-laser pump sources for directed energy applications such as unmanned aerial vehicle designators/imagers and next generation weapons applications such as space-based lasers and airborne lasers. Demonstrate high electrical efficiency (approximately 20%) and compact packaging, exhibiting high power density (10 milliwatts per cubic centimeter) to enable applications requiring laser mobility. Demonstrate a 100 watt, packaged fiber laser.</p> <p>(U) \$4,211 Develop and demonstrate laser source and beam control technologies needed to counter current and next generation air-to-air and surface-to-air missile threats. Demonstrate a reliable and scalable, one watt average power, four micron wavelength, solid state laser for current generation threats to aircraft platforms.</p> <p>(U) \$451 Develop and demonstrate novel target coupling technologies needed to counter current and next generation air-to-air and surface-to-air missile threats. Demonstrate ultra-fast laser beam control and target coupling effects for countering focal plane array seekers.</p> <p>(U) \$8,866 Total</p> <p>(U) <u>FY 2001 (\$ in Thousands)</u></p> <p>(U) \$3,858 Develop low-cost, scalable, high power solid state laser architectures by integrating doped fiber lasers with diode-laser pump sources for directed energy applications such as unmanned aerial vehicle designators/imagers and next generation weapons applications such as space-based and airborne lasers. Demonstrate high electrical efficiency (approaching 25%) and compact packaging, exhibiting high power density (30 milliwatts per cubic centimeter) to enable applications requiring laser mobility. Demonstrate a fiber laser module at several 100s of watts of power.</p> <p>(U) \$1,338 Develop and demonstrate laser source and beam control technologies needed to counter current and next generation air-to-air and surface-to-air missile threats. Demonstrate a reliable and compact five watt average power, four micron wavelength solid state laser for countering current generation threats to aircraft platforms.</p> <p>(U) \$496 Develop and demonstrate novel target coupling technologies needed to counter current and next generation air-to-air and surface-to-air missile threats. Demonstrate a pulsed/ultrafast laser source capable of countering focal plane array seekers.</p> <p>(U) \$5,692 Total</p> <p>(U) <u>B. Project Change Summary</u> Not Applicable.</p>		
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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
03 - Advanced Technology Development	0603605F Advanced Weapons Technology	633151
<p>(U) <u>C. Other Program Funding Summary (\$ in Thousands)</u></p> <p>(U) Related Activities:</p> <p>(U) PE 0602102F, Materials.</p> <p>(U) PE 0603270F, Electronic Combat Technology.</p> <p>(U) PE 0602605F, Directed Energy Technology.</p> <p>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</p> <p>(U) <u>D. Acquisition Strategy</u></p> <p>Not Applicable.</p> <p>(U) <u>E. Schedule Profile</u></p> <p>(U) Not Applicable.</p>		
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BUDGET ACTIVITY 03 - Advanced Technology Development				PE NUMBER AND TITLE 0603605F Advanced Weapons Technology				PROJECT 633152	
COST (\$ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
633152 High Power Microwave Technology	7,926	7,490	8,658	9,290	9,932	8,686	8,858	Continuing	TBD
<p>(U) <u>A. Mission Description</u> This project develops high power microwave (HPM) generation technologies. It also develops a susceptibility/vulnerability/lethality data base to identify potential vulnerabilities of U.S. systems to HPM threats and to provide a basis for future offensive and defensive weapons system decisions. Representative U.S. and foreign assets are tested to understand real system susceptibilities. Both wideband (wide frequency range) and narrowband (very small frequency range) technologies are being developed. The technologies developed in this project will demonstrate the applicability of HPM that can deny/degrade/damage/destroy electronic systems and subsystems for missions such as suppression of enemy air defense, command and control warfare, and aircraft self-protection.</p> <p>(U) <u>FY 1999 (\$ in Thousands)</u> (U) \$3,041 Continued to develop and demonstrate HPM suppression of enemy air defense technologies to render inoperative electronic components of an adversary's Integrated Air Defense System. (U) \$3,223 Continued to develop HPM technologies to support advanced tactical applications. (U) \$1,172 Continued to develop and demonstrate HPM technologies to render inoperative command and control warfare technologies. (U) \$490 Continued to develop and demonstrate nonlethal active denial technology. (U) \$7,926 Total</p> <p>(U) <u>FY 2000 (\$ in Thousands)</u> (U) \$4,263 Develop and demonstrate HPM technologies to render inoperative sample electronic components of an adversary's Integrated Air Defense System. Integrate pulse power and radio frequency source components for an integrated critical experiment for single shot technologies. Demonstrate a repetitively pulsed subscale breadboard HPM system to validate approach and applicability of HPM munitions. (U) \$2,406 Develop and demonstrate HPM technologies to render inoperative sample command and control components of an adversary. Conduct effects experiments to define optimal source parameters for command and control warfare applications. Evaluate technical capabilities of current HPM source concepts through field experiments. Conduct laboratory experiments to demonstrate brassboard compact device critical to development of air-delivered submunitions. Develop initial air-delivered HPM submunition payload design. Conduct validation of computer models developed under applied research funds. (U) \$821 Develop, demonstrate, and evaluate active denial technology for multiple mission applications including future peacekeeping assignments. Develop and demonstrate high specific power non-lethal directed energy source technology for man-portable applications. Demonstrate vehicle-mounted non-lethal directed energy weapons technology.</p>									
<div style="display: flex; justify-content: space-between;"> Project 633152 Page 9 of 15 Pages Exhibit R-2A (PE 0603605F) </div>									

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BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology	PROJECT 633152
<p>(U) <u>A. Mission Description Continued</u></p> <p>(U) <u>FY 2000 (\$ in Thousands) Continued</u></p> <p>(U) \$7,490 Total</p> <p>(U) <u>FY 2001 (\$ in Thousands)</u></p> <p>(U) \$3,723 Develop and demonstrate high power microwave (HPM) technologies to render inoperative electronic components of an adversary's Integrated Air Defense System. Demonstrate and quantify the effectiveness of a repetitively pulsed system against electronic targets of interest. Conduct a full power breadboard demonstration to validate repetitively pulsed capability.</p> <p>(U) \$3,204 Develop and demonstrate HPM technologies to render inoperative command and control components of an adversary. Conduct field experiments with brassboard devices to demonstrate command and control warfare effectiveness. Conduct ground-based, field experiments demonstrating effectiveness of air-delivered HPM sub-munition. Transition selected technologies. Apply computer codes to predict coupling to targets and validate their accuracy.</p> <p>(U) \$1,231 Develop, demonstrate, and evaluate active denial technology for multiple mission applications including future peacekeeping assignments. Complete demonstrations of vehicle-mounted non-lethal directed energy weapons technology. Start hardware development for ancillary subsystems for man-portable applications.</p> <p>(U) \$500 Develop active denial technologies for airborne platform applications as recommended by Phase I of the Directed Energy Applications in Tactical Airborne Combat study. Analyze critical technologies for airborne active denial, including beam control, source efficiency, antenna gain, and aircraft integration.</p> <p>(U) \$8,658 Total</p> <p>(U) <u>B. Project Change Summary</u> Not Applicable.</p> <p>(U) <u>C. Other Program Funding Summary (\$ in Thousands)</u></p> <p>(U) Related Activities:</p> <p>(U) PE 0602202F, Human Systems Technology.</p> <p>(U) PE 0602605F, Directed Energy Technology.</p> <p>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</p> <p>(U) <u>D. Acquisition Strategy</u> Not Applicable.</p> <p>(U) <u>E. Schedule Profile</u></p>		
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<p>(U) <u>E. Schedule Profile Continued</u></p> <p>(U) Not Applicable.</p>		

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BUDGET ACTIVITY

03 - Advanced Technology Development

PE NUMBER AND TITLE

0603605F Advanced Weapons Technology

PROJECT

633647

COST (\$ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
633647 High Energy Laser Technology	19,785	21,752	18,476	17,895	18,298	18,980	21,285	Continuing	TBD

(U) **A. Mission Description**

This project provides for the development, demonstration, and detailed assessment of technology needed for high energy laser weapons. Near-term focus is on ground-based and airborne high energy laser missions, although the technology developed for this project is directly applicable to most high energy laser applications. Critical technologies demonstrated include laser beam control to efficiently compensate and propagate laser radiation through the atmosphere to a target. Detailed computational models to establish high energy laser weapon effectiveness and satellite and missile vulnerability will be developed. Correcting the laser beam for distortions induced by propagation through the turbulent atmosphere is the key technology in most high energy laser applications. The beam control technology developed in this project has a significant benefit to the astronomy community.

(U) **FY 1999 (\$ in Thousands)**

- (U) \$2,085 Continued to develop and demonstrate the technology for scalable, high efficiency, high energy laser devices for potential weapon applications.
- (U) \$1,493 Performed vulnerability assessments on potential high energy laser targets to provide critical data for designing laser systems which can defeat a range of targets and to provide critical data for designing system level protection against laser threats.
- (U) \$746 Continued to investigate and develop advanced, high energy laser optical components.
- (U) \$9,677 Performed atmospheric compensation and laser beam control experiments from ground-based platforms to support applications ranging from weaponization to space object identification.
- (U) \$5,784 Continued to characterize atmospheric attenuation and distortion on laser beam propagation from airborne platforms, conducted atmospheric compensation and beam control experiments, and developed an airborne ultra-precision inertial pointing brassboard to enhance boost phase theater ballistic missile tracking.
- (U) \$19,785 Total

(U) **FY 2000 (\$ in Thousands)**

- (U) \$500 Develop and demonstrate the technology for scalable, high efficiency, high energy laser devices for potential weapon applications. Complete assessment of an efficient, wavelength-shifted chemical oxygen-iodine laser (COIL) device, for application as a moderate- to high-power illuminator laser. Using COIL computer models, evaluate candidate advanced COIL concepts to identify promising approaches for significant improvements.
- (U) \$960 Perform vulnerability assessments on potential high energy laser targets to provide critical data for designing laser systems which can defeat a range of targets and to provide critical data for designing systems protected against laser threats. Re-define the counterspace system-level

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03 - Advanced Technology Development	0603605F Advanced Weapons Technology	633647
(U) <u>A. Mission Description Continued</u>		
(U) <u>FY 2000 (\$ in Thousands) Continued</u>		
	lethality criterion for high energy lasers, based on the evaluation of data from individual satellite vulnerability assessments. Transition to the Space Warfare Center an improved tool for the analysis of high resolution optical images for space surveillance. Complete studies to evaluate capabilities for data fusion between optical imagery and radar data from space surveillance.	
(U) \$200	Investigate and develop advanced, high energy laser optical components for future weapon systems. Continue the investigation of high performance optical coatings (ultra-low absorption, low scatter) to enable uncooled high energy laser optical components, with emphasis on low-stress designs applicable to lightweight mirror and window substrates.	
(U) \$8,850	Perform atmospheric compensation/beam control experiments from large aperture ground-based platforms to support applications ranging from weaponization to space object identification. Characterize and optimize the performance of the advanced adaptive optics system on the 3.5 meter telescope at the Starfire Optical Range (SOR) in compensating for the optical distortions induced by atmospheric turbulence, including the stressing low elevation angles. Conduct satellite illumination experiments on a range of unaugmented space objects to evaluate and anchor detailed computer models. Demonstrate active (daylight) tracking of selected space objects at low bandwidth. Begin investigation of advanced adaptive optics concepts with the potential to improve compensation performance at lower elevation angles. Continue the development of a 50-watt sodium-wavelength laser, for use as the high-altitude beacon for high-performance, full-aperture compensation of the SOR 3.5 meter telescope.	
(U) \$8,742	Develop and evaluate beam control/compensation techniques for atmospheric attenuation and distortion on laser beam propagation from airborne platforms for applications such as theater missile defense. Continue evaluation of advanced concepts for active tracking and atmospheric compensation under propagation conditions representative of typical airborne laser engagement scenarios. Then conduct laboratory experiments under precisely controlled conditions to evaluate and optimize performance under realistic turbulence conditions. Conduct realistic extended-beacon tracking and atmospheric compensation experiments against an instrumented target board on the side of an aircraft, under propagation conditions scaled to represent those expected in airborne laser engagement scenarios using the Atmospheric Compensation Testbed, at North Oscura Peak, White Sands Missile Range, NM.	
(U) \$2,500	Investigate the Laser Spark missile countermeasure technology. Develop and demonstrate the infrared countermeasures effectiveness of the multiple internal laser effects (MILE) associated with plasma/sparks. Perform laboratory testing of MILE on advanced focal plane array (FPA) seeker mockups using properly formatted laboratory lasers. Develop flyout simulations of MILE on conical scan and FPA seekers. Complete effectiveness studies on seekers in operational scenarios. Perform initial design planning and coordination for a limited field demonstration of aimpoint control and countermeasure effectiveness on in-flight seekers.	
(U) \$21,752	Total	
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<p>(U) <u>A. Mission Description Continued</u></p> <p>(U) <u>FY 2001 (\$ in Thousands)</u></p> <p>(U) \$702 Perform vulnerability assessments on potential high energy laser targets to provide critical data for designing laser systems which can defeat a range of targets and to provide critical data for designing systems protected against laser threats. Review/develop the system-level deny/disrupt/damage/destroy criterion for counterspace high energy laser systems, based on new data from satellite vulnerability assessments. Provide data from sure-safe analysis to U.S. Space Command, for use in the potential revision of standards for laser illumination of space objects used by the Laser Clearinghouse. Implement an improved architecture enhancing data fusion and exploitation of optical and radar sensor data for space surveillance missions.</p> <p>(U) \$202 Investigate and develop advanced, high energy laser optical components for future weapon systems. Demonstrate performance of high performance, low stress optical coatings, to enable uncooled high energy laser optical components using lightweight substrates.</p> <p>(U) \$8,761 Perform atmospheric compensation/beam control experiments from ground-based platforms to support applications ranging from weaponization to space object identification. Integrate the Rayleigh beacon laser and wavefront sensor with the Starfire Optical Range (SOR) 3.5 meter telescope and begin Rayleigh guidestar atmospheric compensation optimization against stars and satellite targets. Complete the development and begin integration of a 50-watt sodium-wavelength laser, for use as the high-altitude laser guidestar beacon for high-performance, full-aperture compensation of the SOR 3.5 meter telescope. Begin development of the sodium-wavelength beacon wavefront sensor and the wavefront reconstruction processor for atmospheric compensation.</p> <p>(U) \$8,811 Develop and evaluate beam control/compensation techniques for atmospheric attenuation and distortion on laser beam propagation from airborne platforms for applications such as theater missile defense. Continue evaluation of additional advanced concepts for active tracking and atmospheric compensation using adaptive optics under propagation conditions representative of typical airborne laser engagement scenarios. Conduct static and dynamic active tracking and atmospheric compensation experiments using advanced concepts under propagation conditions scaled to represent those expected in airborne laser engagement scenarios using the upgraded Atmospheric Compensation Testbed, White Sands Missile Range, NM. Compare experimental results with the predictions of detailed wave-optics computer simulations to evaluate and optimize performance.</p> <p>(U) \$18,476 Total</p> <p>(U) <u>B. Project Change Summary</u> Not Applicable.</p>		
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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
03 - Advanced Technology Development	0603605F Advanced Weapons Technology	633647
<p>(U) <u>C. Other Program Funding Summary (\$ in Thousands)</u></p> <p>(U) Related Activities:</p> <p>(U) PE 0602605F, Directed Energy Technology.</p> <p>(U) PE 0603319F, Airborne Laser Demonstration.</p> <p>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</p> <p>(U) <u>D. Acquisition Strategy</u></p> <p>Not Applicable.</p> <p>(U) <u>E. Schedule Profile</u></p> <p>(U) Not Applicable.</p>		

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